

# Amodel® AT-1002 HS

## polyphthalamide

Amodel® AT-1002 HS is a neat, toughened, heat stabilized polyphthalamide (PPA) resin that offers superior retention of properties after humid thermal aging; high impact at low temperature and better mechanical properties than many unreinforced thermoplastic polyester and nylon resins.

This material was specifically designed for automotive electrical/electronic applications such as connectors, sockets and sensors.

- Natural: AT-1002 HS NT

### General

|                           |   |   |
|---------------------------|---|---|
| Material Status           | • Commercial: Active  |   |
| Availability              | • Africa & Middle East<br>• Asia Pacific<br>• Europe  | • Latin America<br>• North America  |
| Additive                  | • Heat Stabilizer<br>• Impact Modifier  | • Lubricant<br>• Mold Release   |
| Features                  | • Chemical Resistant<br>• Ductile<br>• Heat Stabilized<br>• Hot Water Moldability                           | • Impact Modified<br>• Low Temperature Impact Resistance<br>• Low Warpage<br>• Lubricated |
| Uses                      | • Automotive Applications<br>• Automotive Electronics<br>• Automotive Under the Hood                        | • Machine/Mechanical Parts<br>• Metal Replacement<br>• Valves/Valve Parts                 |
| RoHS Compliance           | • RoHS Compliant  |   |
| Automotive Specifications | • DELPHI MS008756 Color: NT Natural<br>• FORD WSS-M98P14-A3 <sup>1</sup><br>• GM GMP.PPA.015 Color: Natural | • GM GMW16799P-PPA Color: Natural<br>• IMDS ID 11974222 Color: Natural                    |
| Appearance                | • Natural Color   |   |
| Forms                     | • Pellets   |   |
| Processing Method         | • Water-Heated Mold Injection Molding   |   |

| Physical                 | Dry  | Conditioned | Unit              | Test method |
|--------------------------|------|-------------|-------------------|-------------|
| Density                  | 1.13 | --          | g/cm <sup>3</sup> | ISO 1183/A  |
| Molding Shrinkage        |      |             |                   | ASTM D955   |
| Flow                     | 2.0  | --          | %                 |             |
| Across Flow              | 2.1  | --          | %                 |             |
| Water Absorption (24 hr) | 0.50 | --          | %                 | ASTM D570   |

| Mechanical      | Dry  | Conditioned | Unit | Test method |
|-----------------|------|-------------|------|-------------|
| Tensile Modulus |      |             |      |             |
| --              | 2760 | 2760        | MPa  | ASTM D638   |
| 23°C            | 2760 | --          | MPa  | ISO 527-2   |
| 100°C           | 2100 | --          | MPa  | ISO 527-2   |
| Tensile Stress  |      |             |      |             |
| Yield, 23°C     | 75.2 | --          | MPa  | ISO 527-2   |
| Yield, 100°C    | 38.6 | --          | MPa  | ISO 527-2   |
| Break, 23°C     | 68.3 | --          | MPa  | ISO 527-2   |
| --              | 83.4 | 76.5        | MPa  | ASTM D638   |

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## polyphthalamide

| Mechanical                              | Dry      | Conditioned | Unit              | Test method               |
|---|----------|-------------|-------------------|---------------------------|
| Tensile Strain                          |          |             |                   |                           |
| Yield, 23°C                             | 5.0      | --          | %                 | ISO 527-2                 |
| Yield, 100°C                            | 3.7      | --          | %                 | ISO 527-2                 |
| Break <sup>2</sup>                      | 80       | 100         | %                 | ASTM D638                 |
| Break, 23°C                             | 15       | --          | %                 | ISO 527-2                 |
| Flexural Modulus                        |          |             |                   |                           |
| --                                      | 2210     | 2280        | MPa               | ASTM D790                 |
| 23°C                                    | 2280     | --          | MPa               | ISO 178                   |
| 100°C                                   | 1720     | --          | MPa               | ISO 178                   |
| Flexural Strength                       |          |             |                   |                           |
| --                                      | 103      | 73.1        | MPa               | ASTM D790                 |
| 23°C                                    | 79.3     | --          | MPa               | ISO 178                   |
| 100°C                                   | 49.6     | --          | MPa               | ISO 178                   |
| Shear Strength                          | 64.1     | 57.2        | MPa               | ASTM D732                 |
| Impact                                  |          |             |                   |                           |
| Charpy Notched Impact Strength (23°C)   | 13       | --          | kJ/m <sup>2</sup> | ISO 179/1eA               |
| Charpy Unnotched Impact Strength (23°C) | No Break | --          |                   | ISO 179/1eU               |
| Notched Izod Impact                     |          |             |                   |                           |
| --                                      | 140      | 150         | J/m               | ASTM D256                 |
| 23°C                                    | 13       | --          | kJ/m <sup>2</sup> | ISO 180/1A                |
| Unnotched Izod Impact Strength (23°C)   | No Break | --          |                   | ISO 180/1U                |
| Instrumented Dart Impact (Total Energy) | 54.2     | 47.5        | J                 | ASTM D3763                |
| Penetration Impact <sup>3</sup>         | 4448     | 4003        | N                 | ASTM D3763                |
| Thermal                                 |          |             |                   |                           |
| Deflection Temperature Under Load       |          |             |                   |                           |
| 0.45 MPa, Annealed                      | 163      | --          | °C                | ASTM D648                 |
| 1.8 MPa, Unannealed                     | 118      | --          | °C                | ISO 75-2/Af               |
| 1.8 MPa, Annealed                       | 121      | --          | °C                | ASTM D648                 |
| Melting Temperature                     | 315      | --          | °C                | ISO 11357-3<br>ASTM D3418 |
| CLTE                                    |          |             |                   | ASTM E831                 |
| Flow : 0 to 100°C                       | 7.8E-5   | --          | cm/cm/°C          |                           |
| Flow : 100 to 200°C                     | 1.3E-4   | --          | cm/cm/°C          |                           |
| Transverse : 0 to 100°C                 | 9.3E-5   | --          | cm/cm/°C          |                           |
| Transverse : 100 to 200°C               | 1.4E-4   | --          | cm/cm/°C          |                           |
| Electrical                              |          |             |                   |                           |
| Surface Resistivity                     | 8.0E+13  | 2.5E+13     | ohms              | ASTM D257                 |
| Volume Resistivity                      | 1.2E+16  | 7.0E+14     | ohms·cm           | ASTM D257                 |
| Dielectric Strength                     | 17       | 17          | kV/mm             | ASTM D149                 |
| Dielectric Constant                     |          |             |                   | ASTM D150                 |
| 60 Hz                                   | 3.30     | 3.80        |                   |                           |
| 1 MHz                                   | 3.30     | 3.80        |                   |                           |
| Dissipation Factor                      |          |             |                   | ASTM D150                 |
| 60 Hz                                   | 4.0E-3   | 0.018       |                   |                           |
| 1 MHz                                   | 0.016    | 0.035       |                   |                           |

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| Electrical                            | Dry   | Conditioned | Unit   | Test method |
|---------------------------------------|-------|-------------|--------|-------------|
| Comparative Tracking Index            | > 600 | > 600       | V      | ASTM D3638  |
| High Voltage Arc Tracking Rate (HVTR) | 12.0  | 12.0        | mm/min | UL 746      |

| Flammability              | Dry | Conditioned | Unit | Test method |
|---------------------------|-----|-------------|------|-------------|
| Flame Rating <sup>4</sup> | HB  | --          |      | UL 94       |

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| Injection               | Dry Unit         |
|-------------------------|------------------|
| Drying Temperature      | 110 °C           |
| Drying Time             | 4.0 hr           |
| Suggested Max Moisture  | 0.030 to 0.060 % |
| Rear Temperature        | 304 °C           |
| Front Temperature       | 324 °C           |
| Processing (Melt) Temp  | 321 to 329 °C    |
| Screw Speed             | 100 to 200 rpm   |
| Screw Compression Ratio | 2.5:1.0          |

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### Injection Notes

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INJECTION RATE: 1 to 3 in/sec

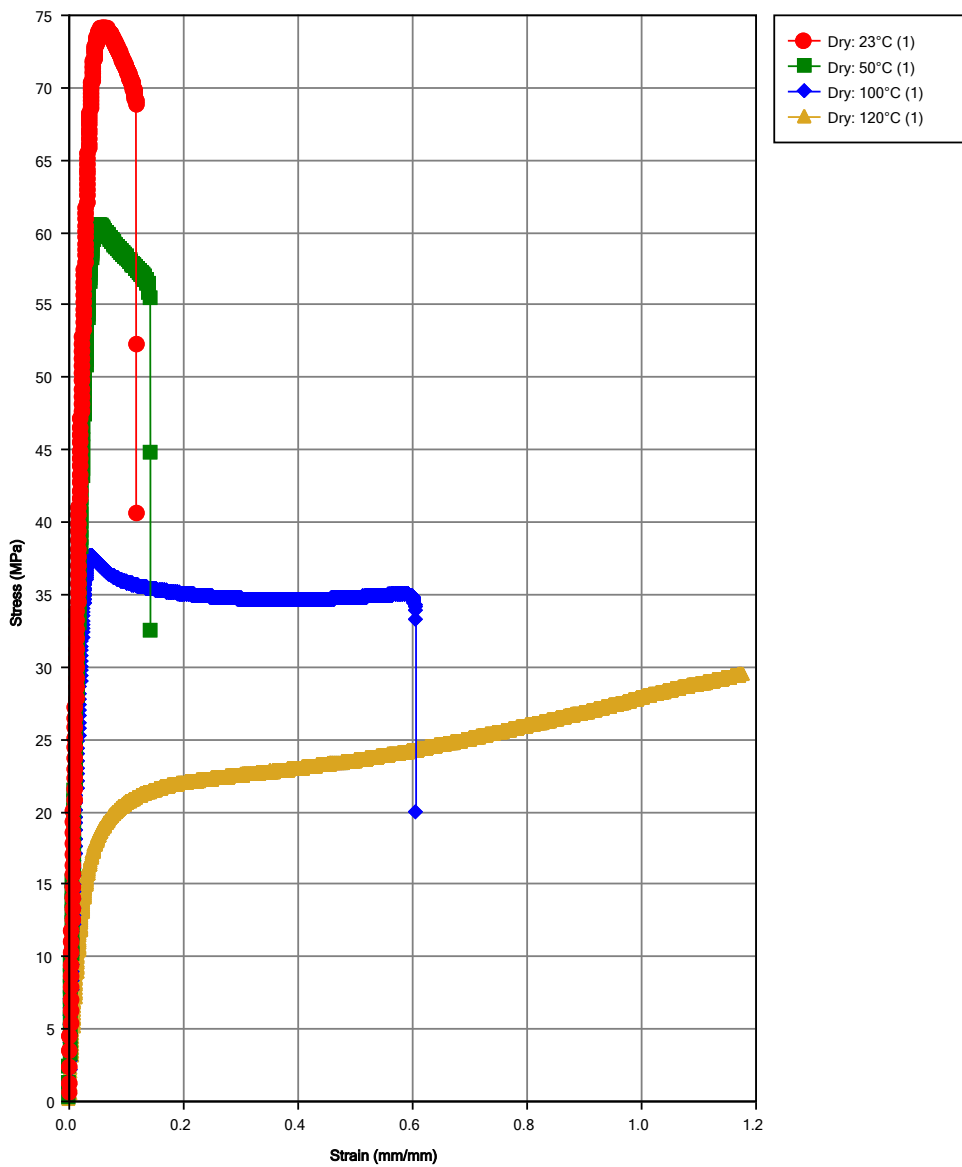
HOLDING PRESSURE: 50% of injection pressure

### STORAGE:

- Amodel® compounds are shipped in moisture-resistant packages at moisture levels according to specifications. Sealed, undamaged bags should be preferably stored in a dry room at a maximum temperature of 50°C (122°F) and should be protected from possible damage. If only a portion of a package is used, the remaining material should be transferred into a sealable container. It is recommended that Amodel® resins be dried prior to molding following the recommendations found in this datasheet and/or in the Amodel® processing guide.
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## Isothermal Stress vs. Strain (ISO 11403-1)



### Data Notes

(1) - 2 in/min (50 mm/min)

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## Notes

Typical properties: these are not to be construed as specifications.

<sup>1</sup> Approval listed in Ford MATS system to this fuel performance specification, as well as to Ford WSS-M98P14-A7.

<sup>2</sup> Type IV

<sup>3</sup> Maximum Load

<sup>4</sup> This rating is not intended to reflect hazards presented by this or any other material under actual fire conditions.

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